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IS : 9071 (Part II) - 1979

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Indian Standard
CODE OF PRACTICE FOR CONTROL OF AFLATOXIN IN GROUNDNUT
PART II PLANT STORAGE AND PROCESSING FLOUR AND OIL

UDC 634·58 : 665·1·031·2 : 632·4 AFLA : 632·93

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IS:9071(PART II)-1979 CODE OF PRACTICE FOR CONTROL OF AFLATOXIN IN GROUNDNUT PART II PLANT STORAGE AND PROCESSING FLOUR AND OIL

Corrigendum

(*Page 6, Table 1, Note, line 1*) – Substitute 'Other' *for* 'Lower'.

(AFDC 37)

Reprography Unit, ISI, New Delhi, India

Indian Standard

CODE OF PRACTICE FOR CONTROL OF AFLATOXIN IN GROUNDNUT

PART II PLANT STORAGE AND PROCESSING FLOUR AND OIL

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(*Continued on page* 2)

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(*Continued on page* 10)

Indian Standard

CODE OF PRACTICE FOR CONTROL OF AFLATOXIN IN GROUNDNUT

PART II PLANT STORAGE AND PROCESSING FLOUR AND OIL

0. FOREWORD

0.1 This Indian Standard (Part II) was adopted by the Indian Standards Institution on 26 February 1979, after the draft finalized by the Nutrition Sectional Committee had been approved by the Agricultural and Food Products Division Council.

0.2 The groundnut is by far the largest oilseed crop in India with a share of over half the total oilseeds produced. Some part of the groundnuts produced are consumed directly, and a large proportion is used for the expression of oil in village *GHANIS*, screw presses or solvent-extraction units. The oil is used in India in unrefined or refined form, and the cake or solvent-extracted meal is exported in huge quantities.

0.3 In 1960, it was discovered that the common mould *Aspergillus flavus* could grow on groundnuts and groundnut cakes to produce highly-toxic materials, the aflatoxins. In young animals which are at a stage of rapid growth, these toxins interfere with cell division and cause death. In older animals, including man, they are implicated in liver cirrhosis, and possibly in cancer. As a result, very low permissible levels of aflatoxin for oilcakes and edible flours have been laid down in many countries. Apart from nutritional implications, there are economic ones also since exported cakes or flours can be rejected if the prescribed levels of aflatoxins are exceeded.

0.4 The major danger of mould infestation occurs during the harvesting and drying of groundnuts in the field, and their subsequent storage in the warehouse or *MANDI*. Accordingly IS : 9071 (Part I)-1979* is being issued simultaneously with this standard which gives specific recommendations to minimize mould attack and toxin development in groundnuts at all stages prior to purchase of seed by the user. IS : 5686-1970† gives detailed directives for sound procedures applicable to oilseeds in general.

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*Code of practice for control of aflatoxin in groundnut: Part I Harvesting, transport and storage of groundnut kernels.

†Code of practice for handling and storage of oilseeds.

0.5 IS : 4427-1967* provides useful guidelines to general quality for purchase of groundnuts. The specific suggestions given in this document are for buying nuts of high quality, with a good storage potential, as judged in terms of various indicators. Once groundnuts are bought during the main arrival season, they may have to be stored in the oil mills for periods as long as even nine months before processing. Mould infestation can easily develop during such storage unless precautions are taken. Groundnuts can be processed through a screw press or expeller to yield crude groundnut oil and an oilcake. If the crude oil is subsequently alkali refined and bleached, aflatoxins should be totally eliminated. In India, however, a considerable proportion of the groundnut oil is used for cooking in the raw form. It has been shown that 10-20 percent of the toxins in the nuts pass into the raw oil, which may, therefore, carry high levels of aflatoxin, posing a considerable health hazard.

0.6 This standard gives directives for each of these user stages. Criteria are laid down for the purchase of groundnuts. Next, measures designed to control the level of aflatoxin during seed storage at the oil mill are outlined. This is followed by steps to reduce the aflatoxin level in the starting material prior to its processing by suitable sorting and pre-processing of the nuts themselves. Such operations are always necessary to ensure oilcake of good quality, and are especially important when the resulting meal has to be of a quality suitable for human consumption, as defined in the three standards IS : 4684-1975†, IS : 4875-1975‡ and IS : 8212-1976§. Procedures for the reduction of aflatoxin in crude groundnut oil both at an industrial level and on a domestic scale have been suggested.

0.7 In the preparation of this standard, considerable assistance has been derived from The Oil Technological Research Institute, Anantapur and The Protein Foods and Nutrition Development Association of India, Bombay.

0.8 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960‖. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Grading of groundnut kernels for oil milling and table use.

†Specification for edible groundnut flour (expeller pressed) (*first revision*).

‡Specification for edible groundnut flour (solvent-extracted) (*first revision*).

§Specification for edible groundnut protein isolate.

‖Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard (Part II) recommends methods for the control of aflatoxin during the buying of groundnuts, their storage, and their processing to oilcake or edible flours, and during the treatment of raw groundnut oil prior to edible use.

2. TERMINOLOGY

2.0 For the purpose of this standard the following definitions shall apply.

2.1 Bags — Jute bags with oilseeds, weighing approximately 90 kg.

2.2 Food Category — The type of nuts where the oil is to be used without further refining or the meal is intended for human consumption.

2.3 Feed Category — The type of nuts where the oil is to be refined or the meal is intended for use as an animal feed.

2.4 *PUCCA* Room — Room with sound flooring, roof, walls and ventilators.

3. BUYING GROUNDNUTS

3.1 End Use — In the case of groundnuts of Food Category, particular care has to be taken in the choice of groundnuts. Buying of Hand-picked Selected (HPS) kernels and their immediate processing is strongly recommended. In the case of groundnuts of Feed Category a slightly greater tolerance is possible, though care in buying is still desirable.

3.2 Groundnut Kernel Quality — Guidelines for the purchase of groundnut kernels under both categories are shown in Table 1.

3.3 Other Oilseeds — The groundnut kernels should also be free from non-edible oilseeds, in particular such toxic oilseeds as castor, *MAHUA* and argemone.

4. STORAGE OF NUTS AT PROCESSING POINT

4.1 Storage Structure — A separate *PUCCA* room with high ceiling, sound flooring, mesh-protected windows and, if possible, exhaust fans would greatly assist sound groundnut storage. If this is not possible, a cemented floor, and a sloping roof of galvanized sheets with sufficient overhang to fully protect the seeds from rain or bird droppings, is desirable. If only storage in the open is possible, the minimum requirement is spread plastic sheets to ensure that there is no direct contact with the ground, and complete covering of the piles of bags or of loose seeds with plastic sheets or tarpaulins.

TABLE 1 GUIDELINES FOR SELECTION OF GROUNDNUT KERNELS/PODS

(*Clause* 3.2)

Sl No.	Characteristic	Requirement for		Method of Test, Ref to
		Food Category	Feed Category	
(1)	(2)	(3)	(4)	(5)
i)	a) Mouldy and discoloured kernels, percent by mass, *Max*	0·5%	1·0%	4 of IS : 3579-1966*
	b) Shrivelled and damaged kernels, percent by mass, *Max*	1·0%	3·0%	
	c) Non-oily refractions, stones, mud, husk, etc, percent by mass, *Max*	Nil	2·0%	
ii)	Moisture content of kernels, percent by mass, *Max*	6·0	6·0	5.1 of IS : 3579-1966*
iii)	Moisture content of pods, percent by mass, *Max*	7·5	7·5	do
iv)	Aflatoxin content of kernels, µg/kg, *Max*	20	100	Appendix J of IS : 4684-1975†
v)	Acid value of extracted oil, *Max*	2·0	6·0	5.3 of IS : 3579-1966*

NOTE — Lower grades of Groundnut kernels for oil milling are categorised in Table 1 of IS : 4427-1967‡.

*Methods of test for oilseeds.

†Specification for edible groundnut flour (expeller pressed) (*first revision*).

‡Grading for groundnut kernels for oil milling and for table use.

4.2 Cleaning and Spraying of Storage Structure — Before the start of the season, and periodically thereafter, the storage structure or area should be thoroughly cleaned and swept down, and all trash, spillage and grains which are thus collected should be burnt, buried or removed far away since they are rich in live insects, eggs and moulds. The area and the walls should be thoroughly sprayed with an emulsified residual insecticide, such as 0·3 percent lindane, or 3 percent malathion at the rate of 5 litres per 100 m^2. The ground surrounding the building to a distance of about 2 m, or the ground used for storage, should also be similarly sprayed. For outdoor treatment 5 percent DDT as wettable powder should be used while for indoor treatment lindane and malathion are preferable.

4.3 Bagging of Groundnuts — Groundnuts in shell (pods) store much better than inner kernels, and the added protection over long storage periods is worth the extra bulk and room needed. If either pods or nuts are bought loose, they should be bagged prior to storage, and the bags used for this purpose should be made insect-free by suitable fumigation treatment, such as exposure to methyl bromide-ethylene dibromide mixtures in air-tight enclosures or chambers. After filling with pods or nuts, the bags should be folded over and stitched or sealed to prevent spillage.

4.4 Stacking of Bags — It is advantageous to permanently mark the stacking design on the ground with white paint. A distance of 1 m from the walls, and between the stacks, should be left free to provide corridors for free passage of workmen withdrawing bags, inspectors, and sprayers. The stacking should not be done on the floor but on wooden pallets (platforms constructed of wooden strips nailed down at right angles). The stacks should not be too big or too high. A 10-m square, 3-metre high stack has several advantages. The stacks may be built up round a central open space which should act as a chimney for hot air to move upwards, thus drawing in cold air by convection from below to promote cooling. Provision of exhaust fans at the top of the storage room will augment cooling.

4.5 Fumigation — After the bags are stacked, particularly at the beginning of the season, any resident infection should be destroyed by enclosing the bags in a sheet of tarpaulin or other sturdy plastic material and exposing the pile to fumigants such as methyl bromide (48 g/m^3) for 36 hours or methyl bromide-ethylene dibromide (24 g/m^3) for 36 hours. It is advantageous to prevent cross-infestation during subsequent storage by spraying the stacks every 3 months using lindane, malathion or pyrethrum spray formulations. If the atmospheric temperature during fumigation is above 20°C, it is more effective and economical to fumigate with a mixture of methyl bromide and ethylene dibromide than methyl bromide alone.

4.6 Continuous Monitoring — Many serious problems can be forestalled by regular inspection. The external relative humidity will determine the seed moisture level, which should be below a critical value, for storage without loss of quality. Strips or paper dried after dipping in 0·1 percent aqueous cobalt thiocyanate solution, if placed at several places in the stacks, will remain blue below a relative humidity of 70 percent, and turn pink when this level is exceeded. This will indicate that the groundnuts in the vicinity run the risk of mould infestation. Hot spots, caused by local seed overheating, should be located and the batch of seed processed at once. Periodically seeds should be withdrawn at random using a metal seed sampler, split open, and examined for fungus patches or brown discoloured spots caused by mould. These seeds should be utilized at once, but not used for manufacture of edible protein products.

5. PROCESSING OF GROUNDNUTS TO PROTEIN AND OIL COMPONENTS

5.1 Sorting — Where an edible flour is to be made, the buying of HPS kernels and their processing as soon as possible may be economical. If pods are bought, they shall carry kernels of very high quality. The first step is then to decorticate the pods by any suitable process, followed by removal of debris by shaker screens or by air blowing.

5.1.1 The kernels in their skins are next subject to sorting, the purpose of which is to remove shrivelled, mouldy or discoloured nuts which often carry high levels of toxins. This operation can be done manually by inspecting the red nuts as they pass along a moving belt. Alternatively photoelectric sorting machines, which discard all nuts which are non-uniform, may be employed. The kernels are then subject to mild roasting (blanching), after which the skins become friable and loose. When the nuts are split, the germs or cuticles also get detached. During roasting, several signs of nut deterioration should be watched for, such as unusual darkening of the red skin, browning of the kernels themselves, and special resistance to nut splitting. The checking of random samples for aflatoxin content at this stage should provide useful pointers to subsequent treatment of the nuts.

5.1.2 Dilution of nuts of very low toxin level with those of higher level to bring the final products within specification limits should never be done. Nuts rejected during sorting procedures should not be used for manufacture of protein products meant for human use.

5.2 Removal of Skins and Germs — Roasting loosens the skins and makes them friable, besides enabling easy splitting of the nuts and detaching of the germs. Split sorted nuts should be freed of red skins and germs by blowing, screening, vibration, separation or other means. Manual sorting of roasted nuts after splitting on a moving belt under ultraviolet light (with proper precautions to protect the eyes of the workers) is very efficacious, since spots of mould show up clearly as a blue, green or yellow fluorescence.

5.3 Oil Expression — Oil may be removed from the cleaned groundnut kernels by the usual method of screw-pressing, which may be followed by subsequent solvent-extraction, or by integrated processing which employs aqueous systems and centrifugal separation. Strict cleanliness and hygiene shall be maintained during these operations.

6. TREATMENT OF CAKE AND OIL

6.1 Treatment of Cake — The resulting cake if derived from nuts of Food Category is likely to be of edible quality. If the cake when made, conforms to such quality, especially in regard to aflatoxin level, no further treatment is desirable. If marginally higher than the limit, the cake may be treated with ammonia gas under slight pressure, or with ozone, to reduce aflatoxin to very low levels.

6.1.1 The resulting cake may also be used for preparation of edible protein isolate by solubilization in alkali, precipitation with acid, centrifugation, washing with water and drying. During the alkali solubilization step, aflatoxin may be destroyed by treatment with hydrogen peroxide. in suitable strength and quantity, after which the excess reagent is destroyed by adding the enzyme catalase. This should only be done when the level of aflatoxin is marginally higher than the limit, since use of the excess oxidising agent required to destroy high aflatoxin levels also tends to destroy protein quality.

6.1.2 Sodium hypochlorite may also be similarly employed to destroy aflatoxin.

6.2 Treatment of Oil — Standard industrial procedures of alkali refining totally destroy aflatoxin, particularly if further followed by bleaching and deodorisation of the oil. For oil which is not thus refined, filtration through a special type filter cloth in place of the filter press cloth now used has been found effective in lowering aflatoxin levels to a safe limit. A procedure for use in the home is to heat the raw groundnut oil to 80°C and wash it when hot with 4 times it own volume of 10 percent sodium chloride (salt) solution, by which the aflatoxin level should be greatly reduced and the oil should be safer to use. Exposure of oil in 10 cm layer to strong sunlight for 15 minutes or in a glass bottle for 1 hour should also greatly reduce the aflatoxin level.

(*Continued from page* 2)

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